WBS 1.10 Staged Schedule

Staged Installation plan

Joe Howell

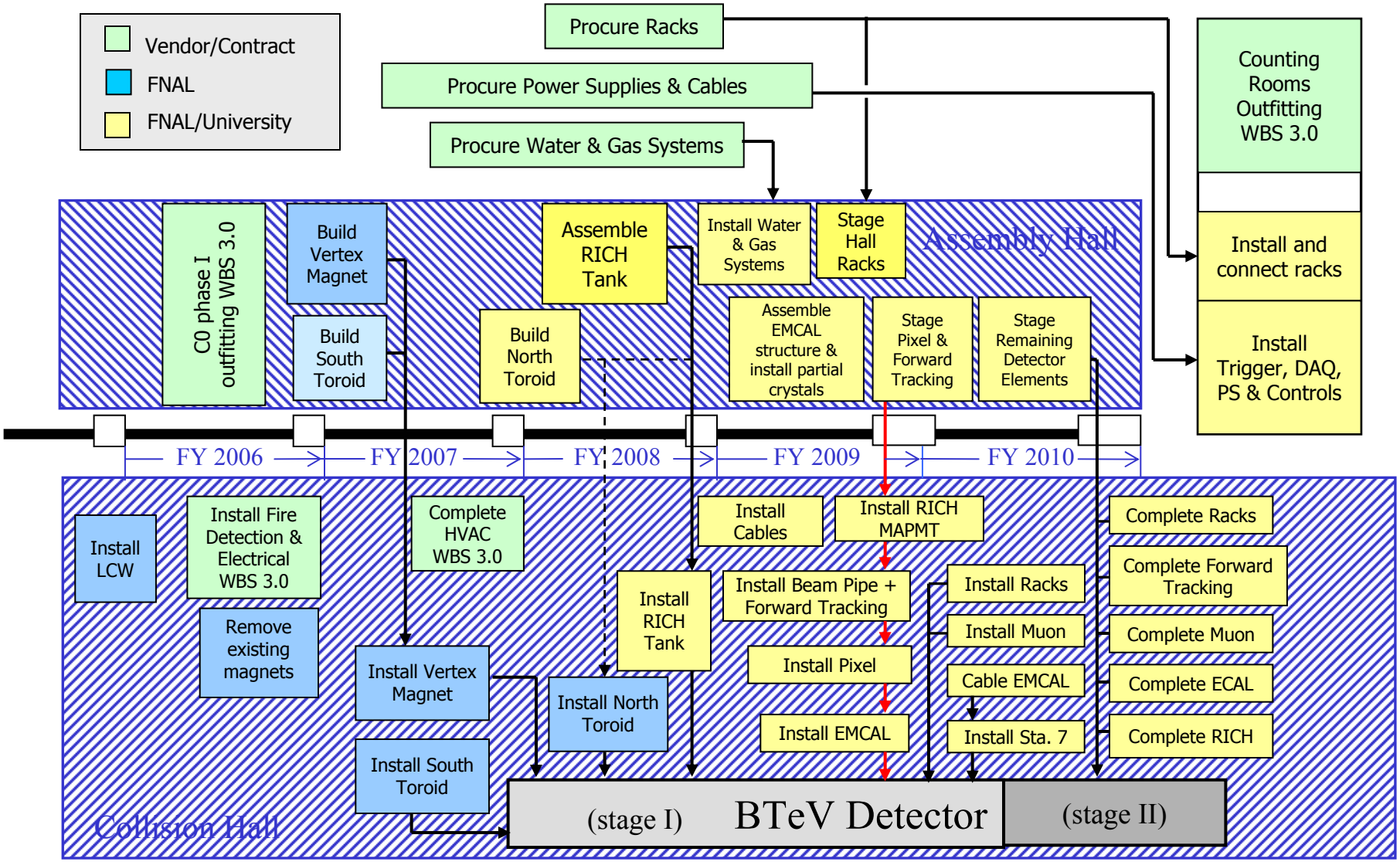
Staged Detector Elements

- Stage I – Installed by end of Aug 1 – Nov 30 Shutdown
  - All Magnets (Vertex, North and South Toroids)
  - Pixel Detector
  - RICH Detector with gas volume instrumented and top PMT
  - Straw Stations 1,2,5,6,7
  - Strip Stations 1,2,5,6
  - ECAL with 50% of the crystals
  - Muon Stations 2 and 3
  - 50% of Trigger and DAQ
- Stage II – Installed in July 1 – Oct 1 Shutdown
  - RICH bottom and side PMT's
  - Straw stations 3,4
  - Strips stations 3,4,7
  - Muon Station 1
  - Remaining 50% of ECAL crystals
  - Remaining 50% of Trigger and DAQ

Changes in installation plan for staged detector

- Vertex and Toroid Magnet installations are not tied to specific shutdowns
- The EMCAL is held in the assembly hall for more crystal installation
- Major installation tasks are shifted away from the production time-frame to avoid conflicts for resources
- Major installations tasks are spread over two extended shutdowns (17 weeks and 13 weeks) which are dedicated to BTeV

Description of Project Flow WBS 1.10



Installation flow in 2005 – 2006 WBS 1.10

2005 Weekly Collision Hall Installation Schedule, a flow chart

2005 shutdown, week starting	8/8				9/5			9/26
Open Shield Door, remove beam pipe								
Remove Magnets + Shield blocks								
Install LCW headers								
Install ODH walls								
Install 4" beam pipe and stands								
Contingency								
Alignment								
Cleanup + Close door								

2006 Weekly Collision Hall Installation Schedule, a flow chart

2006 shutdown, week starting	8/7				9/4			9/25
Open Shield Door, remove beam pipe								
Install Panel boards & Smoke Detection								
Install Electronics Cooling lines								
Install South Toroid (if ready)								
Install North Comp. dipole on blocks (if needed)								
Install Vertex magnet (if ready)								
Hook up VM, TM, and Comp dipoles								
Install conventional beam pipe								
Contingency								
Alignment								
Cleanup and Close Door								

Scheduled activity

Contingency

Installation flow in 2007 – 2008 WBS 1.10

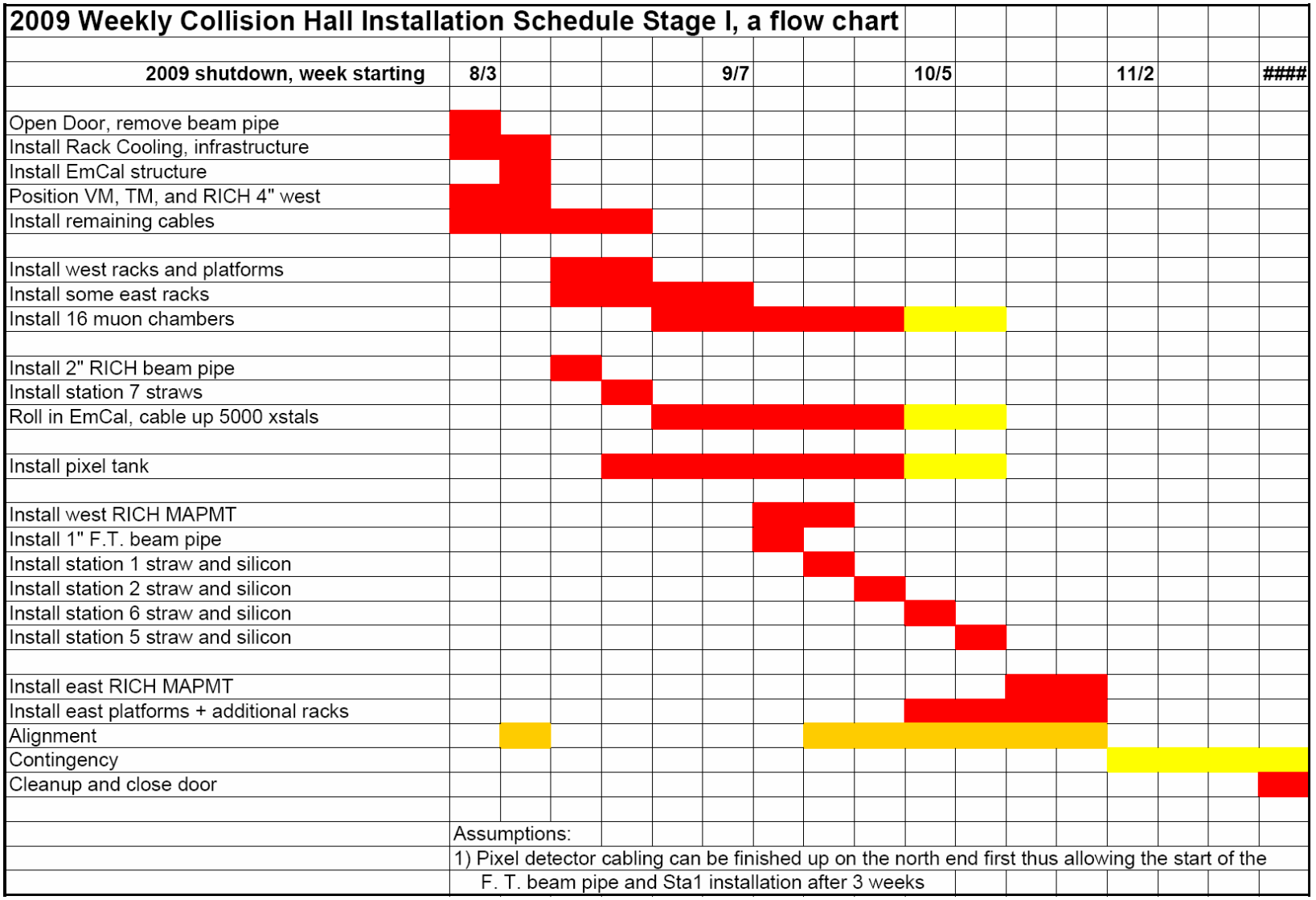
2007 Weekly Collision Hall Installation Schedule, a flow chart								
2007 shutdown, week starting	8/6				9/3			9/24
Open Shield Door, remove beam pipe								
Remove north comp dipole and blocks								
Install fan coil units								
Install north toroid (if ready), beam pipe								
Install some cable trays								
Install 10% pixel								
Contingency								
Alignment								
Cleanup + close door								

2008 Weekly Collision Hall Installation Schedule, a flow chart								
2008 shutdown, week starting -	8/4				9/1			9/22
Open Shield Door, remove beam pipe								
Install some cable trays + cables								
Install some west racks								
Roll in RICH structure, replace beam pipe								
Contingency								
Alignment								
Cleanup + close door								

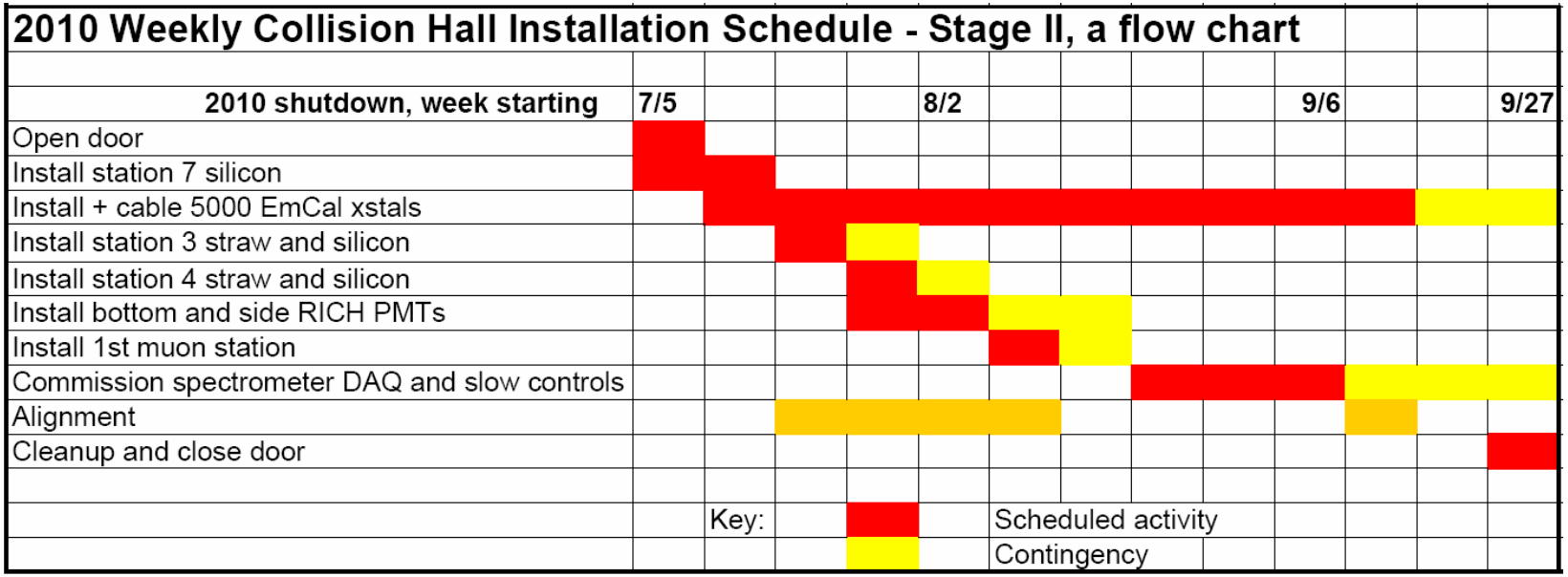
Scheduled activity

Contingency

Installation flow in 2009 WBS 1.10



Installation flow in 2010 WBS 1.10



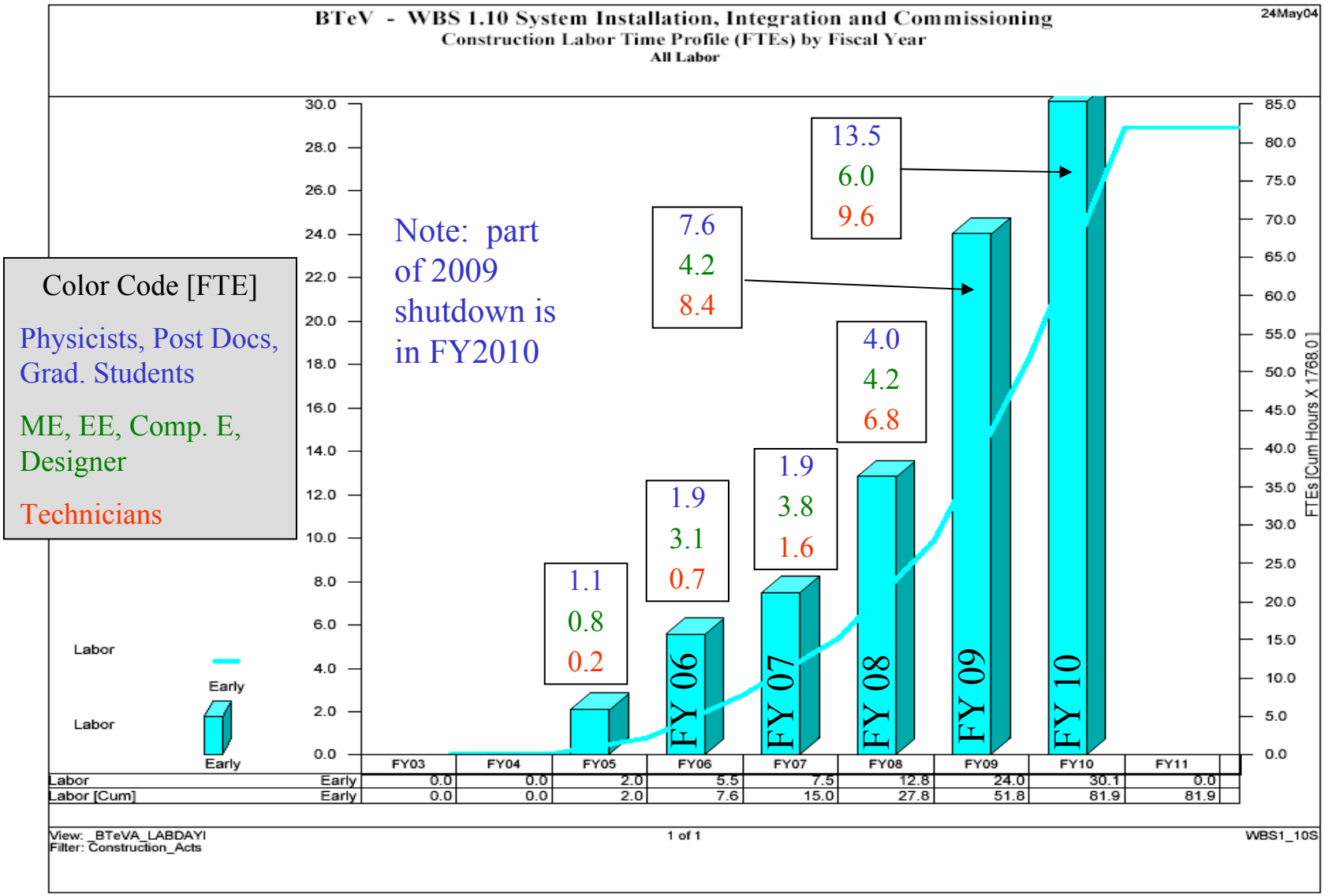
Installation Critical Path

- Stage I Installation
  - Two zones of major work
    - Pixel - Forward Tracking - RICH MAPMT
    - Straw station 7 - EMCAL cabling – Muon Stations
  - Longest Duration Activities
    - Pixel Connections (4 weeks)
    - Straw and Strip Installation (4 weeks)
  - 2009 Shutdown float: 4 weeks on 17 week shutdown (23%)
- Stage II Installation
  - Longest Duration Activity (by far)
    - Crystal installation and cabling (10 weeks)
  - 2010 Shutdown float: 2 weeks on 13 week shutdown (15%)

A sample - Pixel Installation

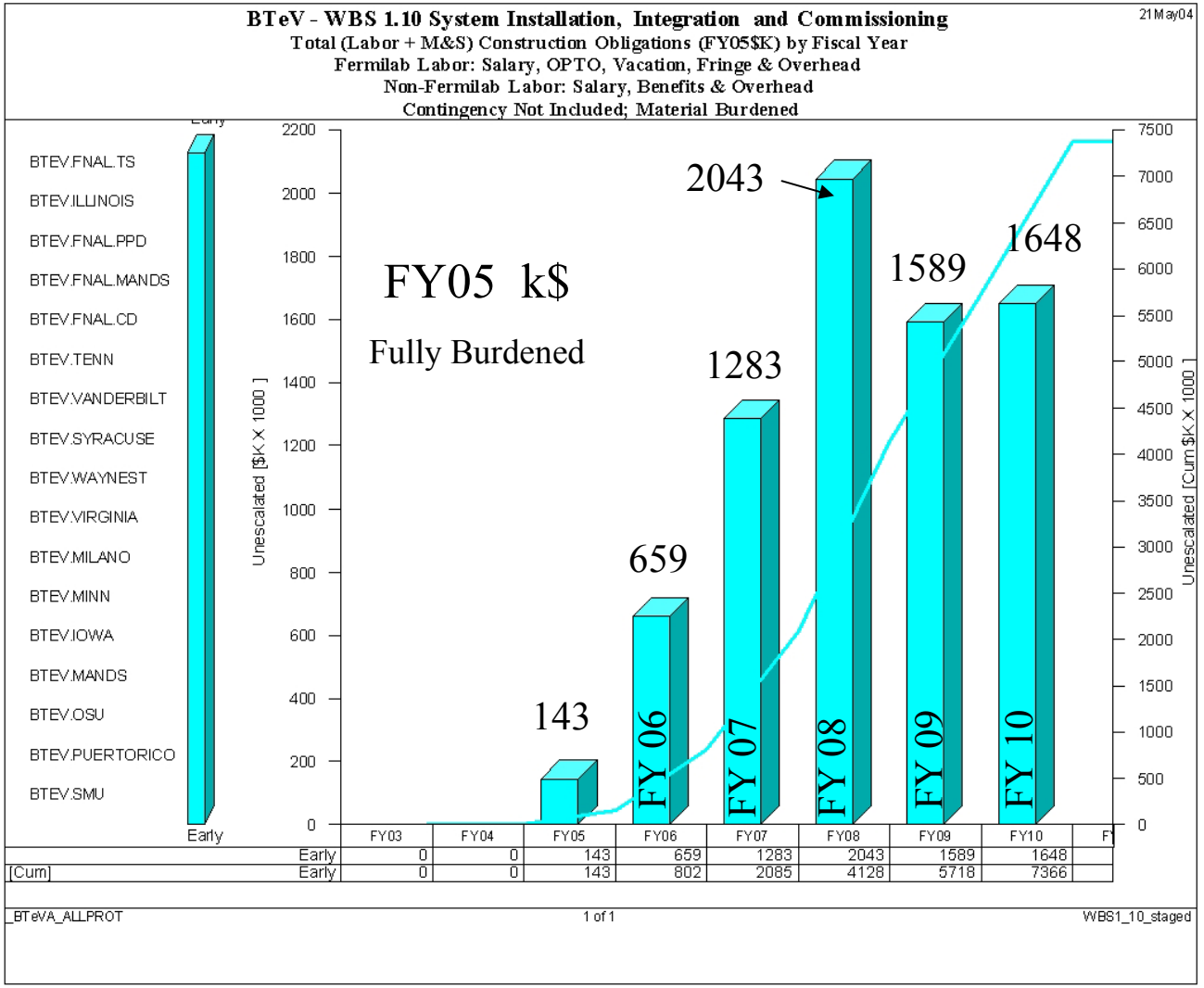
- Prior to installation
  - A significant portion of the cooling, vacuum, temperature control, position control services will be installed and operational.
  - Crates, electronics (PDCB and data links), slow controls modules and cables, power supplies will be installed and tested.
  - The portion of the Trigger and DAQ will be operational (10% test)
- Step 1, Installation in vertex magnet
  - Moving pixel into vertex magnet (1000 kg) with rail system and rough align
  - Time required, 2 days
- Step 2, Connection of Pixel Detector Services
  - Dress cables out of vertex magnet to relay racks
  - Connect to infrastructure (vacuum, cooling, motion control)
  - Final alignment
  - Time required, 5-10 days
- Step 3, Final Electrical Connections and Functionality tests
  - 960 data cables, 1380 HV and 1380 LV cables. HV and LV may be grouped
  - 2 teams of technicians make connections during day shift, group of physicists perform testing during evening shift
  - 64 modules per day
  - Time required, 20-22 days
- Estimates from Simon Kwan and Jim Fast detailed in installation plan
- Benchmark, Run 2b silicon estimate based on run 2a experience
  - B. Quinn: 6 weeks (2 shifts/day) for routing cables and making connections

Labor profile WBS 1.10



Cost profile

WBS 1.10



Cost with Contingency WBS 1.10

Activity ID	Activity Name	Material ($)	Labor($)	Base Cost ($)	Total FY05	Total FY06	Total FY07	Total FY08	Total FY09	Total FY10	Total FY05-10
1.10.1	Installation Integration Testing and Commission Planning	0	433,745	433,745	0	121,765	142,288	296,810	26,191	0	587,054
1.10.2	Infrastructure Development Procurement InstallTest at C0	1,748,438	1,159,169	2,907,607	8,381	592,062	1,184,668	1,749,673	162,370	0	3,697,153
1.10.3	Component and Syst Transport Assembly Install and Connect	185,107	2,962,834	3,147,941	54,759	0	122,196	604,460	3,061,824	2,310,943	6,154,181
1.10.4	Multiple Subsys Interconnect and Int Testing at C0	29,000	560,712	589,712	0	0	0	0	0	1,350,442	1,350,442
1.10.5	System Integration and Testing	23,200	0	23,200	0	0	0	0	0	23,200	23,200
1.10.6	System Install Integrate Commission Subproject Management	48,794	441,577	490,372	127,916	129,955	170,601	150,216	0	0	578,687
1.1	**Subproject 1.10**	**2,034,539**	**5,558,037**	**7,592,576**	**191,057**	**843,782**	**1,619,752**	**2,801,158**	**3,250,384**	**3,684,585**	**12,390,717**

Largest contingency applied in FY09 and FY10

CD-1 Recommendations WBS 1.10

- Develop schedule with adequate contingency using bottom-up information
  - The schedule uses labor and duration information provided by the sub-systems
  - The sub-systems have also re-evaluated their installation tasks and procedures. Some changes include:
    - Eliminating un-necessary survey
    - Increasing the number of installation fixtures to speed installation
- Using engineering design to decrease the installation duration
  - This is an ongoing process that includes:
    - Developing the cable and utility routing details so that that field fitting is minimized.
    - Evaluating detector design features that can speed installation and servicing.
    - Developing comprehensive CAD models of adjacent detectors to check for spatial conflicts.
- Appoint level 2 physicist for installation and integration
  - BTeV Project Management is actively seeking such a person.
- Increase installation contingency to 75%
  - The contingency is now 63% but the base costs were increased $726k because of additional labor applied before and during the second extended shutdown.